

# Complementary MOSFET

ELM14603AA-N

## General Description

ELM14603AA-N uses advanced trench technology to provide excellent  $R_{ds(on)}$  and low gate charge.

## Features

- |                                           |                                         |
|-------------------------------------------|-----------------------------------------|
| N-channel                                 | P-channel                               |
| • $V_{ds}=30V$                            | $V_{ds}=-30V$                           |
| • $I_d=4.7A(V_{gs}=10V)$                  | $I_d=-5.8A(V_{gs}=-10V)$                |
| • $R_{ds(on)} < 55m\Omega (V_{gs}=10V)$   | $R_{ds(on)} < 38m\Omega (V_{gs}=-10V)$  |
| • $R_{ds(on)} < 70m\Omega (V_{gs}=4.5V)$  | $R_{ds(on)} < 63m\Omega (V_{gs}=-4.5V)$ |
| • $R_{ds(on)} < 110m\Omega (V_{gs}=2.5V)$ |                                         |

## Maximum Absolute Ratings

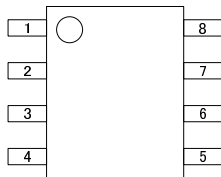
| Parameter                              |                   | Symbol         | N-ch (Max.) | P-ch (Max.) | Unit        | Note |
|----------------------------------------|-------------------|----------------|-------------|-------------|-------------|------|
| Drain-source voltage                   |                   | $V_{ds}$       | 30          | -30         | V           |      |
| Gate-source voltage                    |                   | $V_{gs}$       | $\pm 12$    | $\pm 20$    | V           |      |
| Continuous drain current               | $T_a=25^{\circ}C$ | $I_d$          | 4.7         | -5.8        | A           | 1    |
|                                        | $T_a=70^{\circ}C$ |                | 4.0         | -4.9        |             |      |
| Pulsed drain current                   |                   | $I_{dm}$       | 30          | -40         | A           | 2    |
| Power dissipation                      | $T_a=25^{\circ}C$ | $P_d$          | 2.00        | 2.00        | W           |      |
|                                        | $T_a=70^{\circ}C$ |                | 1.44        | 1.44        |             |      |
| Junction and storage temperature range |                   | $T_j, T_{stg}$ | -55 to 150  | -55 to 150  | $^{\circ}C$ |      |

## Thermal Characteristics

| Parameter                   |              | Symbol         | Device | Typ. | Max.  | Unit          | Note |
|-----------------------------|--------------|----------------|--------|------|-------|---------------|------|
| Maximum junction-to-ambient | $t \leq 10s$ | $R\theta_{ja}$ | N-ch   | 52.0 | 62.5  | $^{\circ}C/W$ | 1    |
| Maximum junction-to-ambient | Steady-state |                |        | 78.0 | 110.0 | $^{\circ}C/W$ |      |
| Maximum junction-to-lead    | Steady-state | $R\theta_{jl}$ |        | 48.0 | 50.0  | $^{\circ}C/W$ | 3    |
| Maximum junction-to-ambient | $t \leq 10s$ | $R\theta_{ja}$ | P-ch   | 50.0 | 62.5  | $^{\circ}C/W$ | 1    |
| Maximum junction-to-ambient | Steady-state |                |        | 73.0 | 110.0 | $^{\circ}C/W$ |      |
| Maximum junction-to-lead    | Steady-state | $R\theta_{jl}$ |        | 31.0 | 35.0  | $^{\circ}C/W$ | 3    |

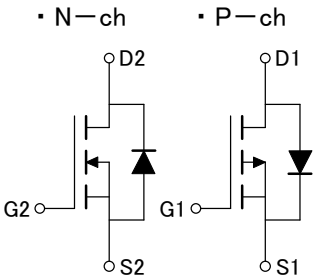
## Pin Configuration

SOP-8 (TOP VIEW)



| Pin No. | Pin name |
|---------|----------|
| 1       | SOURCE2  |
| 2       | GATE2    |
| 3       | SOURCE1  |
| 4       | GATE1    |
| 5       | DRAIN1   |
| 6       | DRAIN1   |
| 7       | DRAIN2   |
| 8       | DRAIN2   |

## Circuit



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## ■ Electrical Characteristics (N-ch)

T<sub>a</sub>=25°C

| Parameter                          | Symbol              | Conditions                                                                                  | Min. | Typ.  | Max. | Unit |
|------------------------------------|---------------------|---------------------------------------------------------------------------------------------|------|-------|------|------|
| STATIC PARAMETERS                  |                     |                                                                                             |      |       |      |      |
| Drain-source breakdown voltage     | BV <sub>dss</sub>   | I <sub>d</sub> =250 μA, V <sub>gs</sub> =0V                                                 | 30   |       |      | V    |
| Zero gate voltage drain current    | I <sub>dss</sub>    | V <sub>ds</sub> =24V<br>V <sub>gs</sub> =0V                                                 |      |       | 1    | μA   |
|                                    |                     | T <sub>j</sub> =55°C                                                                        |      |       | 5    |      |
| Gate-body leakage current          | I <sub>gss</sub>    | V <sub>ds</sub> =0V, V <sub>gs</sub> =±12V                                                  |      |       | 100  | nA   |
| Gate threshold voltage             | V <sub>gs(th)</sub> | V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =250 μA                                   | 0.6  | 1.0   | 1.4  | V    |
| On state drain current             | I <sub>d(on)</sub>  | V <sub>gs</sub> =4.5V, V <sub>ds</sub> =5V                                                  | 10   |       |      | A    |
| Static drain-source on-resistance  | R <sub>ds(on)</sub> | V <sub>gs</sub> =10V<br>I <sub>d</sub> =4A                                                  |      | 45    | 55   | mΩ   |
|                                    |                     | T <sub>j</sub> =125°C                                                                       |      |       |      |      |
|                                    |                     | V <sub>gs</sub> =4.5V, I <sub>d</sub> =3A                                                   |      | 55    | 70   |      |
|                                    |                     | V <sub>gs</sub> =2.5V, I <sub>d</sub> =2A                                                   |      | 83    | 110  |      |
| Forward transconductance           | G <sub>fs</sub>     | V <sub>ds</sub> =5V, I <sub>d</sub> =4A                                                     |      | 8     |      | S    |
| Diode forward voltage              | V <sub>sd</sub>     | I <sub>s</sub> =1A, V <sub>gs</sub> =0V                                                     |      | 0.8   | 1.0  | V    |
| Max.body-diode continuous current  | I <sub>s</sub>      |                                                                                             |      |       | 2.5  | A    |
| DYNAMIC PARAMETERS                 |                     |                                                                                             |      |       |      |      |
| Input capacitance                  | C <sub>iss</sub>    | V <sub>gs</sub> =0V, V <sub>ds</sub> =15V, f=1MHz                                           |      | 390.0 |      | pF   |
| Output capacitance                 | C <sub>oss</sub>    |                                                                                             |      | 54.5  |      | pF   |
| Reverse transfer capacitance       | C <sub>rss</sub>    |                                                                                             |      | 41.0  |      | pF   |
| Gate resistance                    | R <sub>g</sub>      | V <sub>gs</sub> =0V, V <sub>ds</sub> =0V, f=1MHz                                            |      | 3     |      | Ω    |
| SWITCHING PARAMETERS               |                     |                                                                                             |      |       |      |      |
| Total gate charge                  | Q <sub>g</sub>      | V <sub>gs</sub> =4.5V, V <sub>ds</sub> =15V, I <sub>d</sub> =4A                             |      | 0.60  |      | nC   |
| Gate-source charge                 | Q <sub>gs</sub>     |                                                                                             |      | 1.38  |      | nC   |
| Gate-drain charge                  | Q <sub>gd</sub>     |                                                                                             |      | 4.34  |      | nC   |
| Turn-on delay time                 | t <sub>d(on)</sub>  | V <sub>gs</sub> =10V, V <sub>ds</sub> =15V<br>R <sub>L</sub> =3.75 Ω, R <sub>gen</sub> =6 Ω |      | 3.3   |      | ns   |
| Turn-on rise time                  | t <sub>r</sub>      |                                                                                             |      | 1.0   |      | ns   |
| Turn-off delay time                | t <sub>d(off)</sub> |                                                                                             |      | 21.7  |      | ns   |
| Turn-off fall time                 | t <sub>f</sub>      |                                                                                             |      | 2.1   |      | ns   |
| Body-diode reverse recovery time   | t <sub>rr</sub>     |                                                                                             |      | 12.0  |      | ns   |
| Body-diode reverse recovery charge | Q <sub>rr</sub>     | I <sub>f</sub> =4A, dI/dt=100A/μs                                                           |      | 6.3   |      | nC   |

### NOTE :

1. The value of R<sub>θja</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with T<sub>a</sub>=25°C. The value in any given applications depends on the user's specific board design, The current rating is based on the t≤10s thermal resistance rating.
2. Repetitive rating, pulse width limited by junction temperature.
3. The R<sub>θja</sub> is the sum of the thermal impedance from junction to lead R<sub>θjl</sub> and lead to ambient.
4. The static characteristics in Figures 1 to 6 are obtained using 80μs pulses, duty cycle 0.5%max.
5. These tests are performed with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with T<sub>a</sub>=25°C. The SOA curve provides a single pulse rating.

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## Typical Electrical and Thermal Characteristics (N-ch)

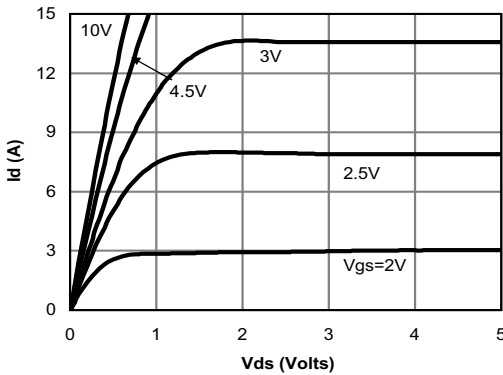


Fig 1: On-Region Characteristics

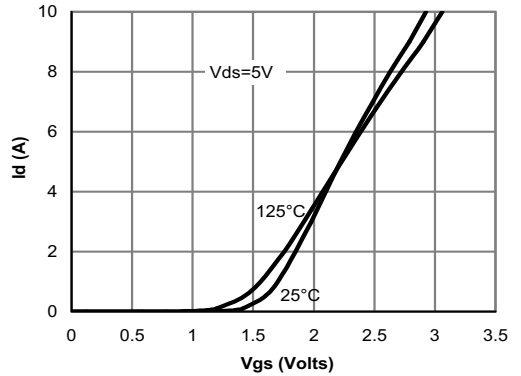


Figure 2: Transfer Characteristics

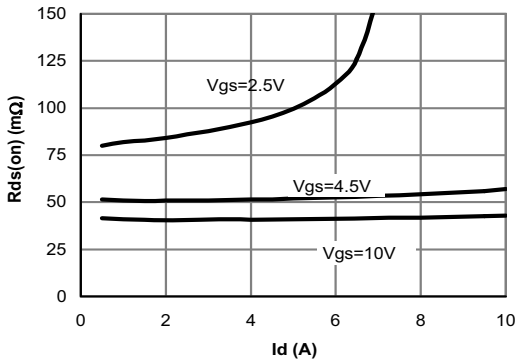


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

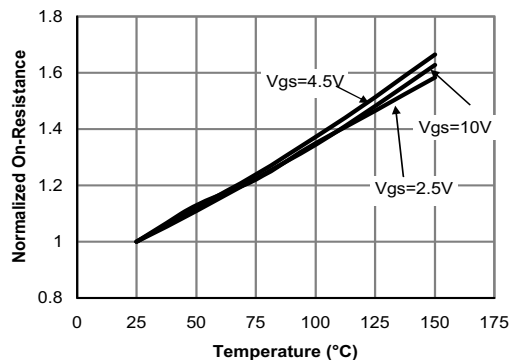


Figure 4: On-Resistance vs. Junction Temperature

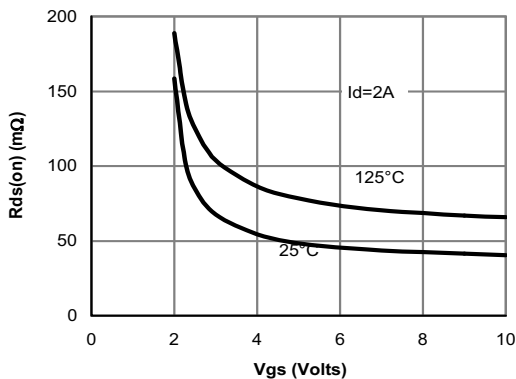


Figure 5: On-Resistance vs. Gate-Source Voltage

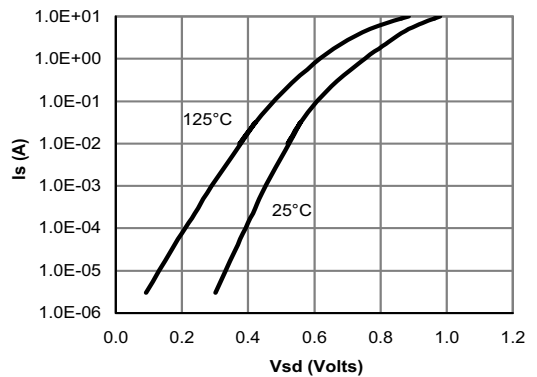


Figure 6: Body-Diode Characteristics

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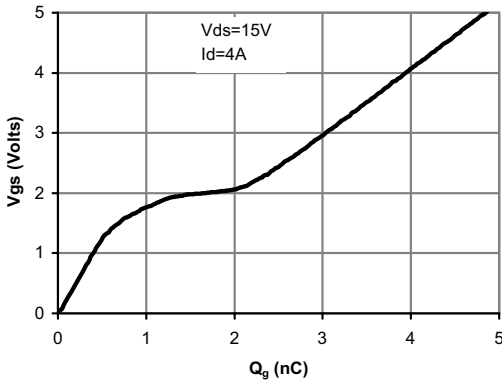


Figure 7: Gate-Charge Characteristics

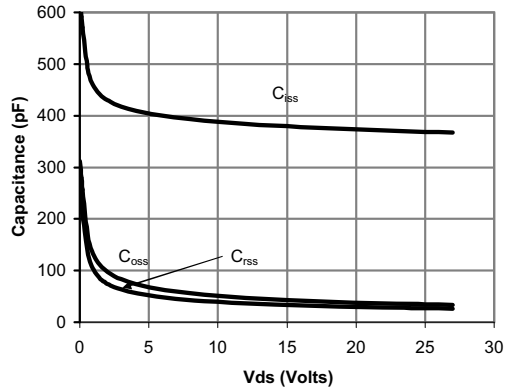


Figure 8: Capacitance Characteristics

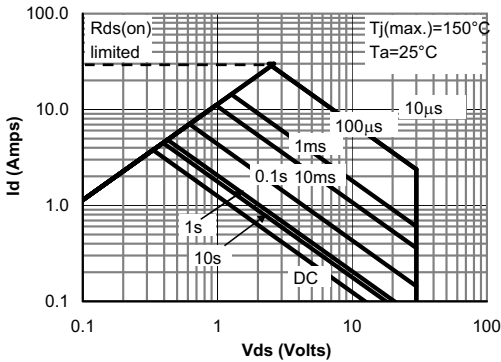


Figure 9: Maximum Forward Biased Safe Operating Area (Note E)

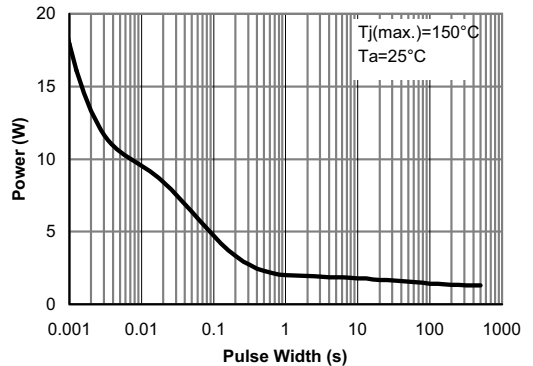


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

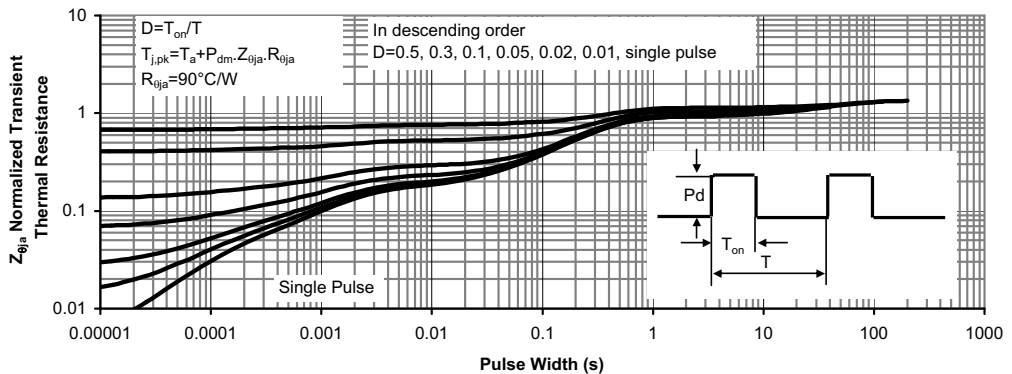


Figure 11: Normalized Maximum Transient Thermal Impedance

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## ■ Electrical Characteristics (P-ch)

T<sub>a</sub>=25°C

| Parameter                          | Symbol              | Conditions                                                                                 | Min. | Typ.     | Max.     | Unit |
|------------------------------------|---------------------|--------------------------------------------------------------------------------------------|------|----------|----------|------|
| STATIC PARAMETERS                  |                     |                                                                                            |      |          |          |      |
| Drain-source breakdown voltage     | BV <sub>dss</sub>   | I <sub>d</sub> =-250 μA, V <sub>gs</sub> =0V                                               | -30  |          |          | V    |
| Zero gate voltage drain current    | I <sub>dss</sub>    | V <sub>ds</sub> =-24V<br>V <sub>gs</sub> =0V                                               |      |          | -1<br>-5 | μA   |
|                                    |                     | T <sub>j</sub> =55°C                                                                       |      |          |          |      |
| Gate-body leakage current          | I <sub>gss</sub>    | V <sub>ds</sub> =0V, V <sub>gs</sub> =±20V                                                 |      |          | ±100     | nA   |
| Gate threshold voltage             | V <sub>gs(th)</sub> | V <sub>ds</sub> =V <sub>gs</sub> , I <sub>d</sub> =-250 μA                                 | -1.2 | -1.8     | -2.2     | V    |
| On state drain current             | I <sub>d(on)</sub>  | V <sub>gs</sub> =-10V, V <sub>ds</sub> =-5V                                                | -40  |          |          | A    |
| Static drain-source on-resistance  | R <sub>ds(on)</sub> | V <sub>gs</sub> =-10V<br>I <sub>d</sub> =-5A                                               |      | 29<br>40 | 38       | mΩ   |
|                                    |                     | T <sub>j</sub> =125°C                                                                      |      |          |          |      |
|                                    |                     | V <sub>gs</sub> =-4.5V, I <sub>d</sub> =-5A                                                |      | 39       | 63       | mΩ   |
| Forward transconductance           | G <sub>fs</sub>     | V <sub>ds</sub> =-5V, I <sub>d</sub> =-10A                                                 |      |          |          | S    |
| Diode forward voltage              | V <sub>sd</sub>     | I <sub>s</sub> =-1A, V <sub>gs</sub> =0V                                                   |      | -0.75    | -1.00    | V    |
| Max. body-diode continuous current | I <sub>s</sub>      |                                                                                            |      |          | -4.2     | A    |
| DYNAMIC PARAMETERS                 |                     |                                                                                            |      |          |          |      |
| Input capacitance                  | C <sub>iss</sub>    | V <sub>gs</sub> =0V, V <sub>ds</sub> =-15V, f=1MHz                                         |      | 920      |          | pF   |
| Output capacitance                 | C <sub>oss</sub>    |                                                                                            |      | 190      |          | pF   |
| Reverse transfer capacitance       | C <sub>rss</sub>    |                                                                                            |      | 122      |          | pF   |
| Gate resistance                    | R <sub>g</sub>      | V <sub>gs</sub> =0V, V <sub>ds</sub> =0V, f=1MHz                                           |      | 3.6      |          | Ω    |
| SWITCHING PARAMETERS               |                     |                                                                                            |      |          |          |      |
| Total gate charge                  | Q <sub>g</sub>      | V <sub>gs</sub> =-10V, V <sub>ds</sub> =-15V<br>I <sub>d</sub> =-7.5A                      |      | 2.4      |          | nC   |
| Gate-source charge                 | Q <sub>gs</sub>     |                                                                                            |      | 4.5      |          | nC   |
| Gate-drain charge                  | Q <sub>gd</sub>     |                                                                                            |      | 9.3      |          | nC   |
| Turn-on delay time                 | t <sub>d(on)</sub>  | V <sub>gs</sub> =-10V, V <sub>ds</sub> =-15V<br>R <sub>L</sub> =2 Ω, R <sub>gen</sub> =3 Ω |      | 7.6      |          | ns   |
| Turn-on rise time                  | t <sub>r</sub>      |                                                                                            |      | 5.2      |          | ns   |
| Turn-off delay time                | t <sub>d(off)</sub> |                                                                                            |      | 21.6     |          | ns   |
| Turn-off fall time                 | t <sub>f</sub>      |                                                                                            |      | 8.0      |          | ns   |
| Body diode reverse recovery time   | t <sub>rr</sub>     | I <sub>f</sub> =-7.5A, dI/dt=100A/μs                                                       |      | 20.0     |          | ns   |
| Body diode reverse recovery charge | Q <sub>rr</sub>     | I <sub>f</sub> =-7.5A, dI/dt=100A/μs                                                       |      | 8.8      |          | nC   |

### NOTE :

1. The value of R<sub>θja</sub> is measured with the device mounted on 1in<sup>2</sup> FR-4 board of 2oz. Copper, in still air environment with T<sub>a</sub>=25°C. The value in any given applications depends on the user's specific board design, The current rating is based on the t≤10s thermal resistance rating.
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## Typical Electrical and Thermal Characteristics (P-ch)

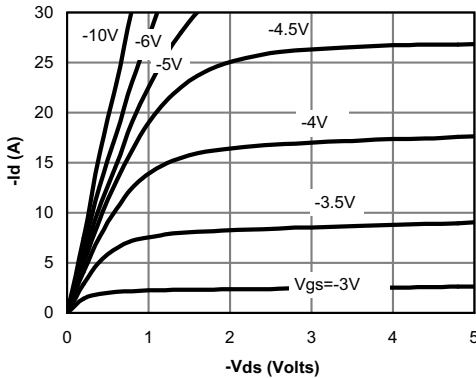


Figure 1: On-Region Characteristics

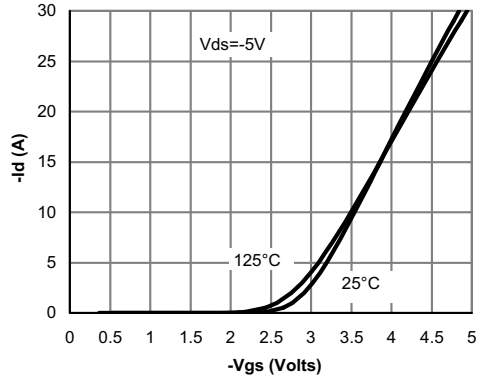


Figure 2: Transfer Characteristics

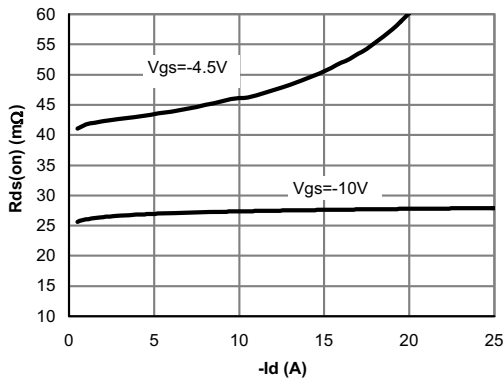


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

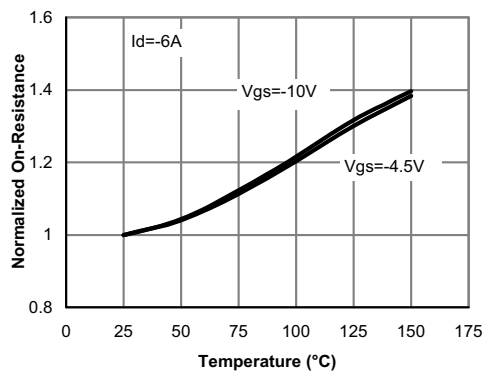


Figure 4: On-Resistance vs. Junction Temperature

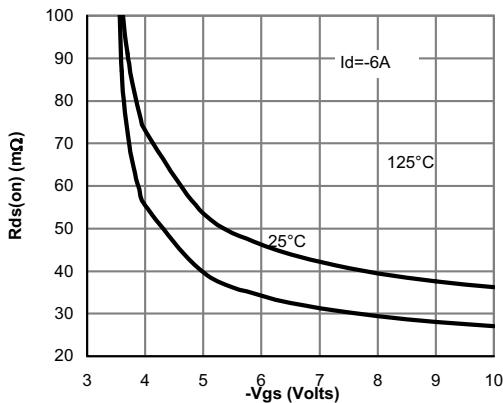


Figure 5: On-Resistance vs. Gate-Source Voltage

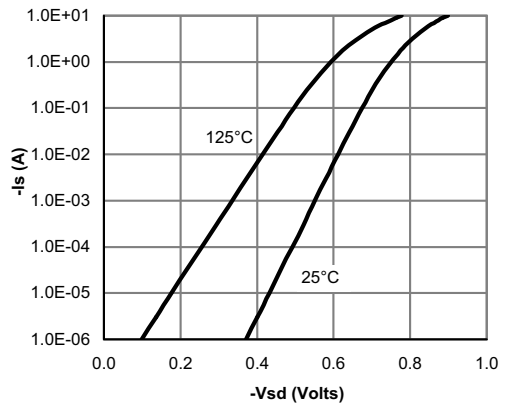


Figure 6: Body-Diode Characteristics

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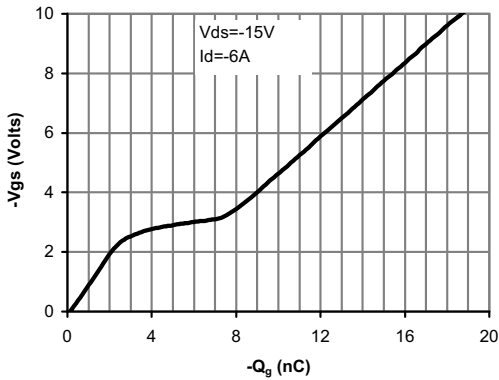


Figure 7: Gate-Charge Characteristics

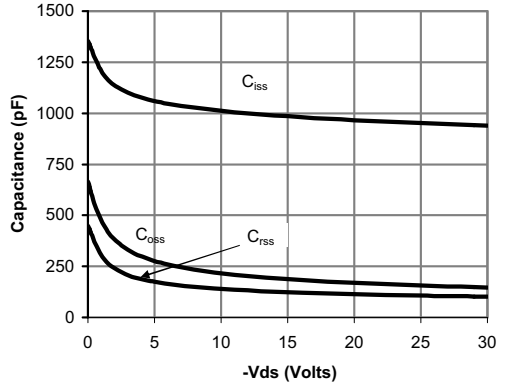


Figure 8: Capacitance Characteristics

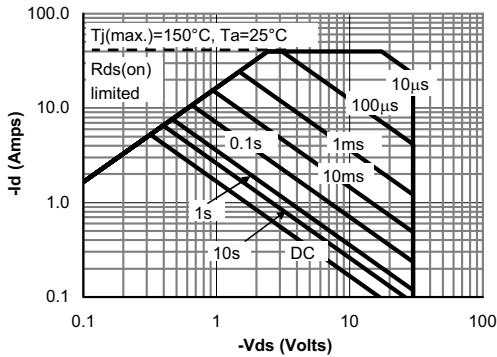


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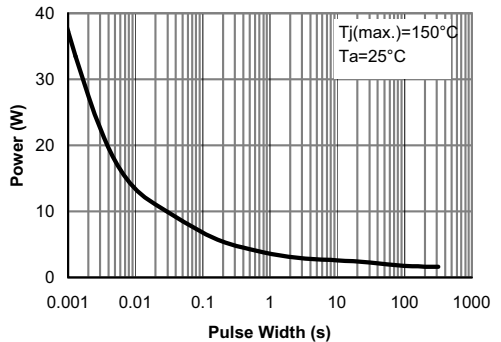


Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note E)

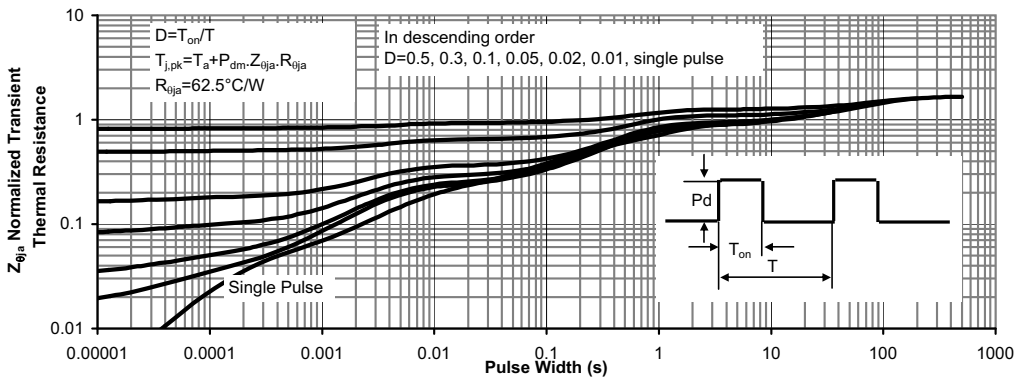


Figure 11: Normalized Maximum Transient Thermal Impedance